

# CONNECTIVITY IN THE RIVER MEUSE

Characteristics of a major (free?) flowing bypass

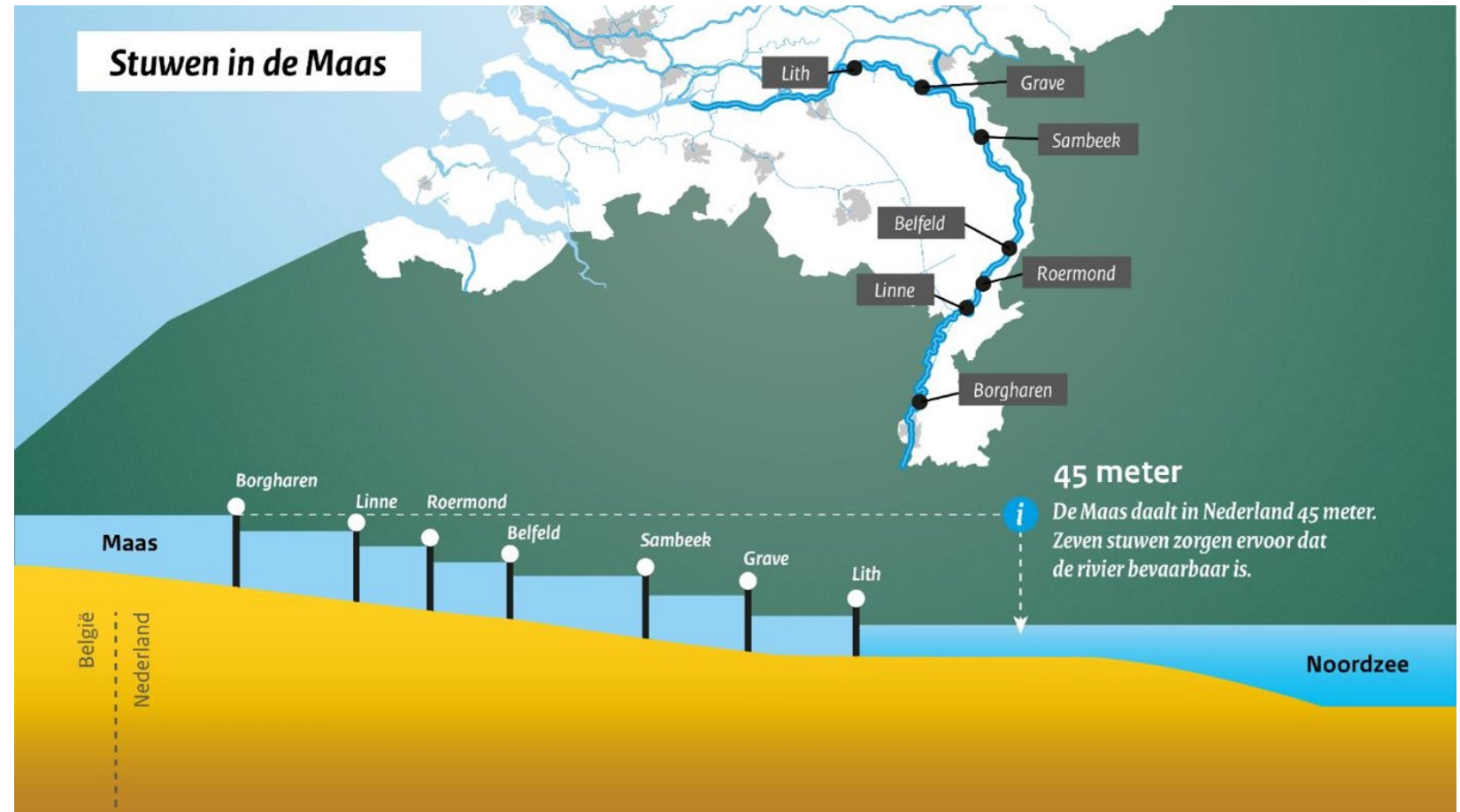
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# The River Meuse

- 1915-1942: Seven sluice-weir complexes + fish passes
- Shipping:
  - Water level constant
  - No sedimentation
- Sand demand
- Lacking in longitudinal (and lateral) connectivity, lotic conditions





# Need for bypass

## Weir Sambeek

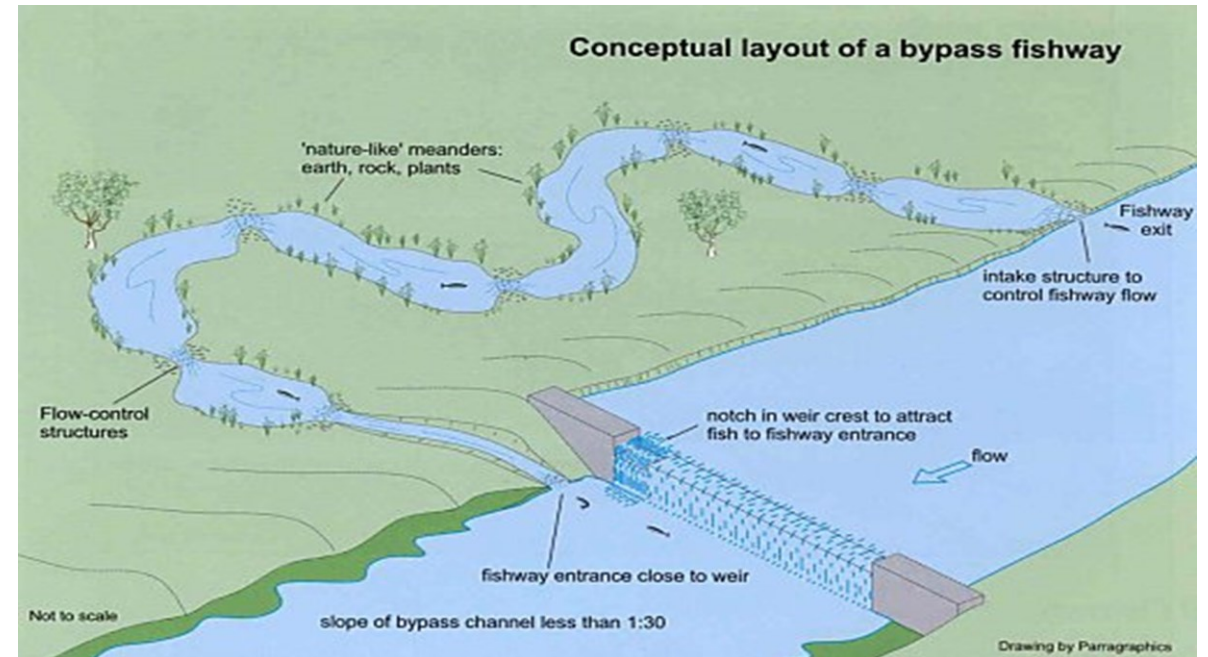
- Belfeld - Grave (70 rkm),
- $\updownarrow$  3.10 m over weir
- At low discharge, priority flow through sluice



Source: [samenwerkenaanriviernatuur.nl](http://samenwerkenaanriviernatuur.nl) (RWS)

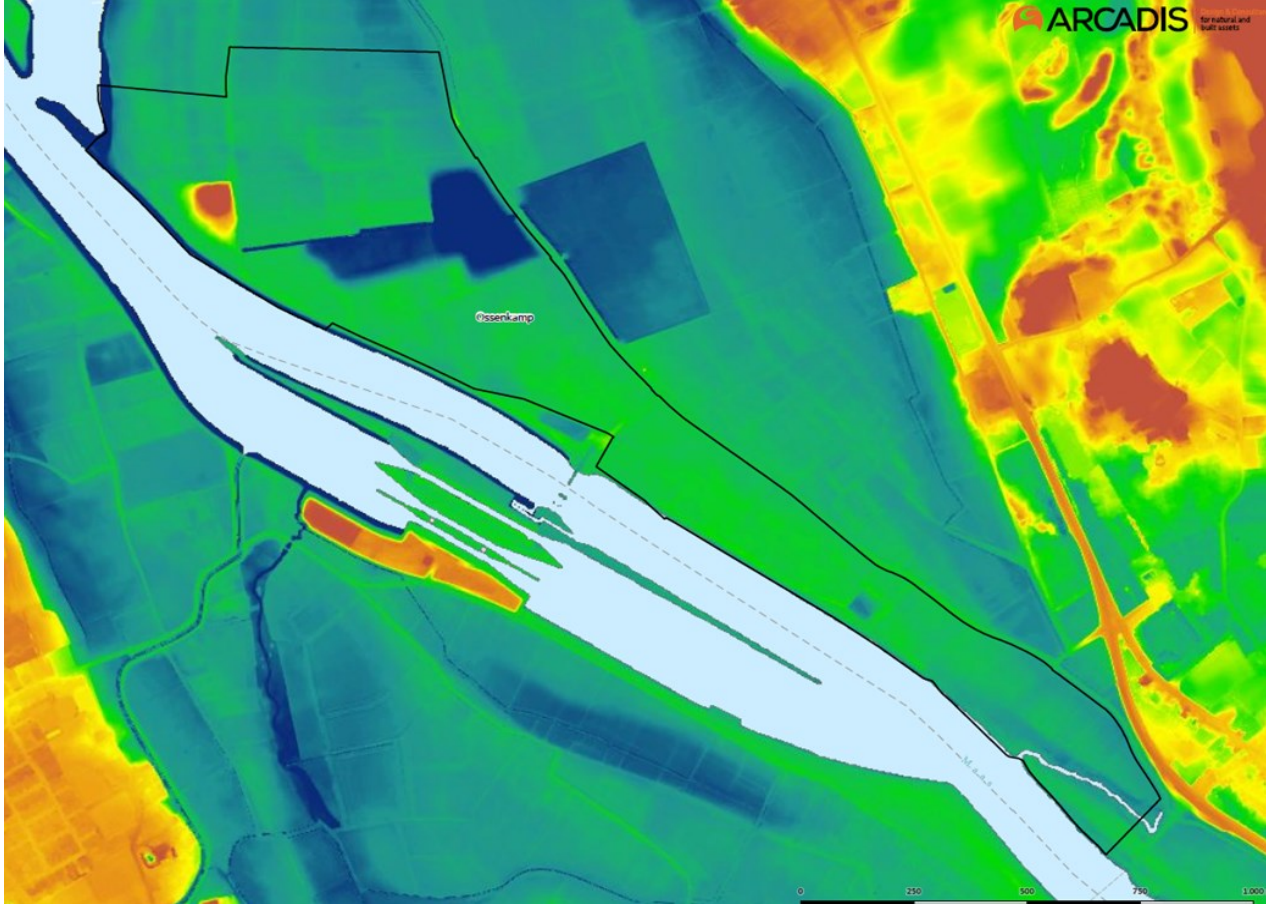
## *Ecological importance (including WFD):*

- Flowing habitat
- More dynamic conditions
- Up- and downstream migration, dispersal



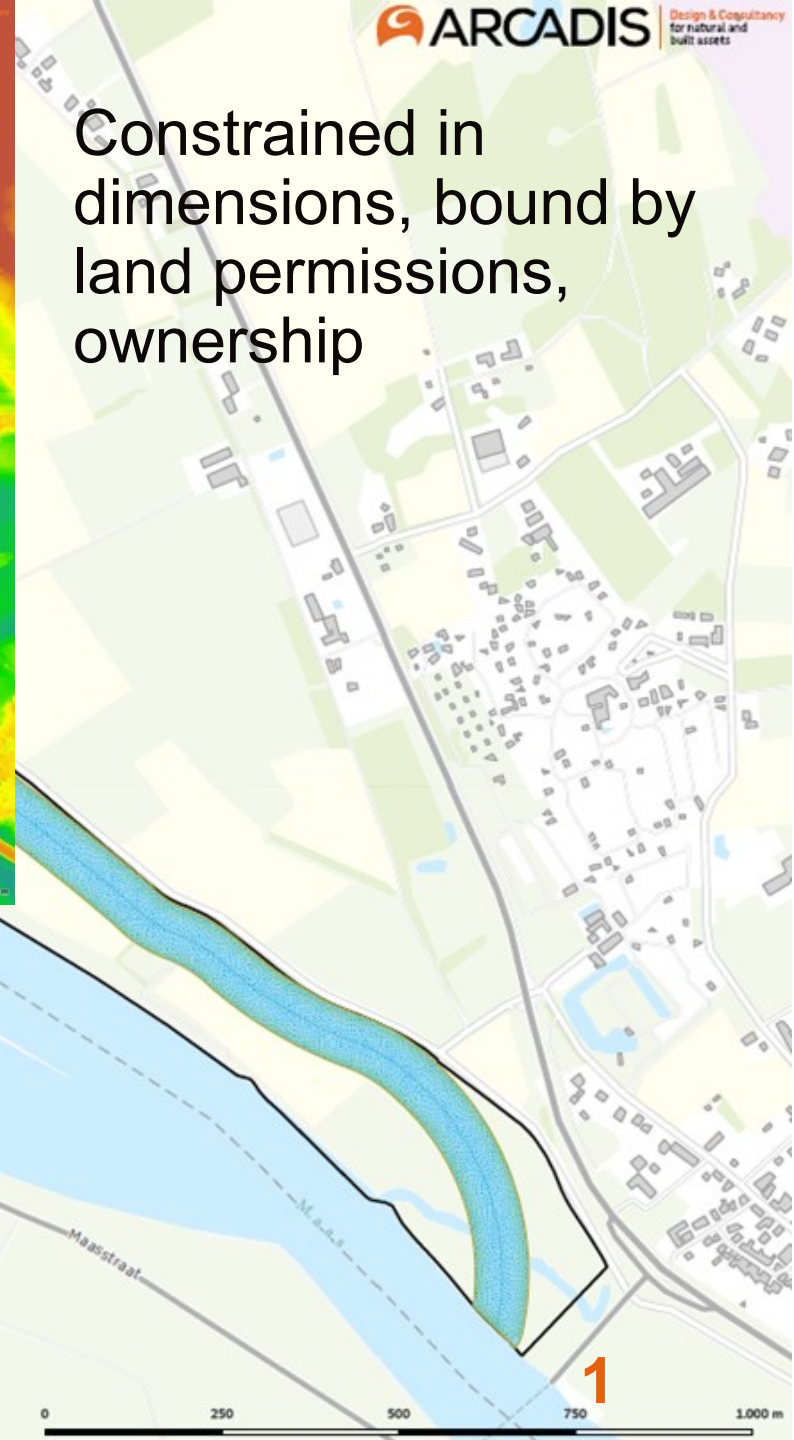


# Spatial limitations



Constrained in dimensions, bound by land permissions, ownership

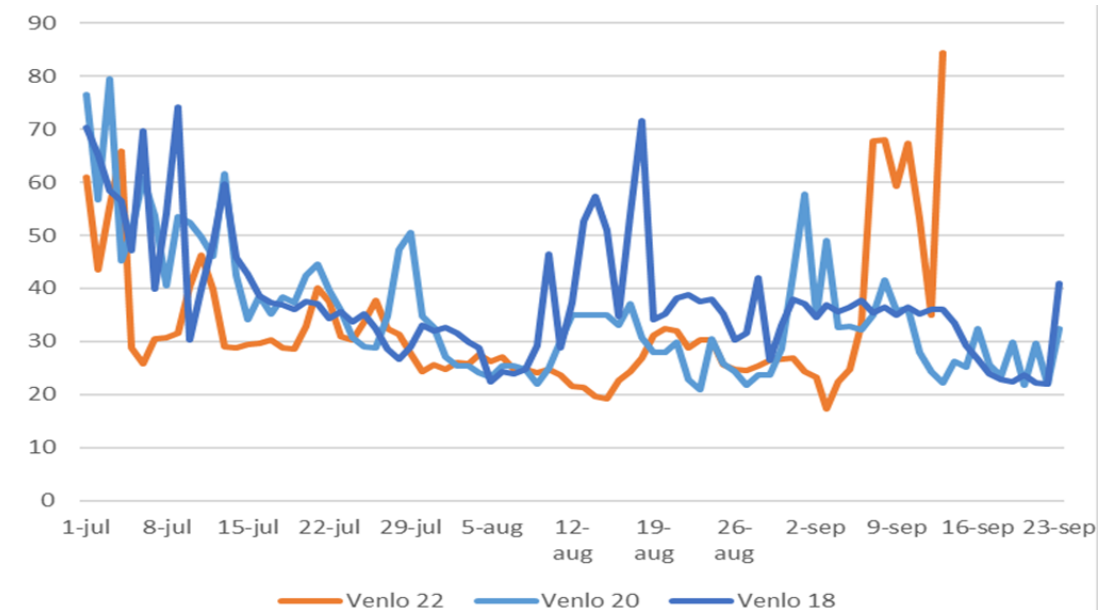
1. Distance from ferry (50 m)
2. Situated alongside track (Stuwweg) for visibility
3. Sluice-weir complex
4. Outflow in summerbed of main channel, upstream of former branch
5. Badger's den (protected species)



# Hydrology

Max feasible flow through bypass at summer levels!

- Dependent on flow availability
- Water levels in Meuse kept constant
- Historical lower limit of 20 m<sup>3</sup>/s (available)
- Climate resilience scenario: 30% reduction in Meuse summer discharge (Deltares)



**Design discharge: 3.5 m<sup>3</sup>/s**



# Morphology

No sedimentation in shipping lane + spatial limitations =  
No erosion in bypass

Research:

Correlation substrate type and current velocity (model)

Design:

- Risk of erosion > mitigation measures required:
  - Velocity barriers on bed
  - Last resort: smaller dimensions of bypass



**Morphological stable flowing channel!**

# Ecology

## **More diverse habitat**

- Substrates, grain size
- Bank gradients
- Flow conditions (0.3-0.8 m/s), depth (0.1-1 m)
- Bypass length (3.2 rkm), reduced shipping effects

## **Connectivity**

- Whole water column (benthic and pelagic species)
- For both weaker and stronger swimmers
- Velocity barriers (if needed) placed evenly
- Inlet always open (but flow control at extremes)



*Longleaf pondweed / Ecopedia.be*



*Yellow-legged dragonfly / Natuurpunt.be*



*Common dace / Jelger Herder (RAVON)*

**Bypass with natural, diverse habitat, improving connectivity!**



# Free flowing?

	Yes	No
Hydrological	No flow control by inlet	Flow control at extremes
Morphological	Local erosion/sedimentation Building with nature	Morphologically stable Bank enforcement for protection against erosion/of structures
Ecological	Improve connectivity Diverse flow/habitat	During extremes: no connectivity (fish)

**Free flowing within the limits!**

# Questions?



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